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ABSTRACT

An overview is presented of the system of education in Ireland, with special reference to teacher education. Educational requirements for the early grades are briefly covered, and changing patterns in schooling are pointed out. The system of higher education is outlined prior to a more in-depth description of the system of teacher education. Included in the description are the qualifications to teach in secondary schools, training for primary education, and degree awarding systems. A discussion of the education and training of teachers in the University of Dublin, Trinity College includes admission requirements, subjects offered, administrative arrangements, the higher diploma in education, and compulsory courses. Appended are the current syllabuses for English and mathematics for the intermediate certificate at the higher and lower levels. (JD)

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The Irish System of Teacher Education

Part 1
(including appendix 1)

Department of Teacher Education
University of Dublin

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The Irish System of Teacher Education

Part 1
(including appendix 1)

Department of Teacher Education
University of Dublin

Series 89/5a

IRELAND: THE SYSTEM OF EDUCATION
(with special reference to Teacher Education)

The Ages of Schooling:

All children between the age of 5 and 15 have to attend school [see Fig.1]. Schooling takes place between the beginning of September and the end of June. There are three terms (semesters). These terms are separated by short vacations of two weeks duration at Christmas and Easter.

The state provides free education for students beyond the age of 15 however at that age the system begins to be selective.

The System of Public Examinations:

Secondary schools make their own provision for selection at the age of transfer to secondary education. At the end of the three year junior cycle students sit the Intermediate Certificate Examination (from 1992 Junior Certificate. See below). The examination (test) papers are set and marked by the Inspectors of the state Department of Education. They are assisted in this work by advising examiners who are practising teachers. The purpose of these examinations is to test the students knowledge and understanding of the subjects learnt during their three years of junior-cycle second level education.

All subjects are studied for the three years. It is the intention that the test papers of the different subjects should be of comparable standard. The examinations in Irish, Mathematics and English are set at two levels called higher and lower. Most student teachers will have passed these three subjects at the higher level.

Students wishing to go to university will typically have passed examinations in eight subjects (e.g. Irish, Mathematics, English, Science, a Modern Language, History, Geography and Commerce). Students taking a modern language will have additional aural and oral tests.

Those students who wish to go to university or to pursue a career in teaching will remain in school for at least two more years of senior-cycle education. At the end of this period they take another public examination also set by the Inspectors of the state Department of Education. These examinations (tests) also test the knowledge and understanding of the subjects studied during the two year period of the senior-cycle. All the tests in this examination which is called the Leaving Certificate Examination, are set at two levels called ordinary and higher.

The syllabuses in English and Mathematics for both the Leaving and Intermediate Certificate examinations are given in an Appendices 1, 2 and 3.

The System of Schooling:

All children attend National Schools for their primary education. When this is completed they may choose to go to a comprehensive (or community) school, a secondary school or a vocational school.

Traditionally second level education was provided by the religious denominations. Fees had to be paid and these schools tended to take

schools were established to provide opportunities for those who would not normally have entered secondary education. A public examination was also provided for these students called the Group Certificate (see below).

When in 1969 education was made free, comprehensive schools and community colleges (comprehensive schools with an adult education section) were introduced to cope with the rapid expansion in the school system. Demographic factors continue to cause changes in the number and type of school. Traditionally student teachers undertook the Higher Diploma in Education course in order to teach in secondary schools but this situation has changed dramatically in the last twenty years, and most intending second level teachers now take a one-year course of teacher training when they have graduated [see below].

The Changing Pattern of Schooling

[i] In 1991 the Intermediate and Group Certificate examinations will be merged to provide a common end of school assessment for all students. The new examination will be called **The Junior Certificate**.

[ii] At the present time about 100 schools are allowed to do a Transition Year (see Fig.1). This is a break in the formal academic curriculum during which the students undertake vocational and community related activities. These will include work experience. Its goals are to:

- discover their own individual talents, aptitudes and abilities with regard to future educational and/or vocational participation
- understand their own particular education and/or vocational needs
- develop those skills and competences necessary to cope successfully with their particular stages of development.

This one year break takes place between the end of the Junior Cycle and the beginning of the two year programmme for the Leaving Certificate.

[iii] It might be anticipated that with the coming of the Single European Legislation in 1992 that Ireland will wish to ensure that its students have the same opportunities for second level education as the students in other countries of the European Economic Community. In which case six as opposed to five years second level education will become the norm and the number of schools offering the transition year might be expected to increase.

The System of Higher (Third Level) Education.

There are two universities, two National Institutes of Higher Education (Universities designate), an Institute of Higher Education in Dublin whose degrees are awarded by the University of Dublin, eight Colleges of Education (teacher training) and 9 Regional Technical Colleges and a number of dimilar institutions to these technical colleges. The universities are also involved in teacher education.

The two universities are the National University of Ireland (with constituent colleges in Cork, Dublin, Galway and Maynooth), and the University of Dublin, Trinity College.

(a) **Admission**

Admission to the universities is by selection against matriculation examination (National University of Ireland), and, or the Leaving Certificate examination. Each university operates a points system. Thus a grade A at

FIG. 1.

ENTERS
NATIONAL (PRIMARY) SCHOOL

YEAR	AGE (approx)	
1	(6)	
2	(7)	
3	(8)	
4	(9)	
5	(10)	
6	(11)	
7	(12)	ENTERS EITHER A

SECONDARY SCHOOL OR
COMPREHENSIVE (COMMUNITY) SCHOOL OR
VOCATIONAL SCHOOL

1	(13)	
2	(14)	
3	(15)	INTERMEDIATE CERTIFICATE EXAMINATION
[4]		TRAN SITION YEAR OPPORTUNITY
5	(16)	
6	(17+)	LEAVING CERTIFICATE EXAMINATION

N.B. Traditionally the two post-Intermediate Certificate years have been called 5th and 6th year (5,6).

a grade B less (e.g. 5) and so on. The pass level of the Leaving Certificate carries relatively little weight. There is no communality between the points systems used by the different Institutions of Higher Education but the net effects on performance in the Leaving Certificate are the same.

Students set out to get as many points as they can in relation to the requirements of the subject(s) and university which they wish to attend. In subjects where there is a high demand and a shortage of places the number of points required will be very high. It may be assumed that at the very least students entering university will have passed (at one grade or another) five subjects at the Leaving Certificate and, that four of these will be taken at honours level. It may also be assumed that most students will have taken English and mathematics at least at the ordinary level. Thus students enter universities having experienced a broad education in a number of subjects set to a common standard.

(b) **Types of Degree Courses**

The degree courses offered by the two universities vary in length. Courses in the National University of Ireland are of three or four years duration but the majority are three. The majority of courses in the University of Dublin are four. In the National University students may take a pass degree (study in two or three subjects) or, an honours degree. Depending on the subject(s) taken the honours degree may be in a single subject or two subjects. In the University of Dublin students may study for a single subject honours degree, or take two subjects with honours (two subject moderatorship). A pass grade may be awarded in some subjects. Thus at the end of three or four years students will have reached a relatively high level of competence in one or two subjects. This has considerable bearing on the requirements for teacher education.

The System of Teacher Education in Ireland.

Separate systems of education operate for the training of teachers for primary and secondary education. Both systems require entrants to the profession to have a university degree with exception of certain semi-professional and trade courses in the vocational sector.

(i) **Second-level Education.**
Although the regulations for teaching in comprehensive, secondary and vocational schools differ, most intending teachers now follow the regulations for secondary schools. All intending teachers must be able to speak Irish and the state Department of education sets tests for this purpose.

(ii) **The Requirements for Teaching in Secondary School.**
The requirements for teaching in secondary schools are determined by the Registration Council for Secondary Teachers which is a statutory body whose recommendations require Ministerial assent.

In brief, a person wishing to be registered as a secondary teacher must have :
(a) a qualification in Irish,
(b) a university degree in a subject (taken for at least three years) in one of the school subjects listed by the Registration Council,
(c) a Higher Diploma in Education,
(d) completed a probationary period of one year in teaching.

following on the three or four year period of university study. The regulations for the Higher Diploma are determined by the Registration Council. The structure and approaches within programmes differ as between the four colleages of the national University of Ireland and the University of Dublin, each of whom offers courses for the Higher Diploma in Education. A description of the Higher Diploma in Education offered by the University of Dublin is given below.

(iii) **Qualifications to teach Art, Home Economics, Music, Metalwork, Physical Education and Woodwork in Secondary Schools**.

Until twelve years ago teachers were trained on two and three year courses specifically for the purpose of teaching these subjects in schools. Since then these courses have been developed in order for them to acquire university degree status.

- Thomond College [Limerick] offers four year B.Ed. (Bachelor in Education) of the National Council for Educational Awards in Commerce, Metalwoking in Technology, Physical Education, Rural Science and Woodwork Technology.
- St. Angela's College of Home Economics (Sligo) offers a four year B. Ed. degree of the National University of Ireland in Home Economics.
- St. Catherine's College of Home Economics (Dublin) offers a four year B.Ed. degree of the University of Dublin in Home Economics.
- Mater Dei Institute (Dublin) offers four year B. Ed. degrees of the National Univeristy of Ireland in Music and Religious Studies.
- The Royal Irish Academy of Music and The Dublin College of Music offer together a four year B. Ed. degree of the Univeristy of Dublin in Music.
- The National College of Art and Design offers a four year B. Ed. degree of the National Council for Educational Awards in Art.

(iv) **Training for Primary Education**.

At the present time five colleges prepare teachers for primary school work. Each of them in associated with one of the two universities for the purpose of university degree recognition. Students associated with the University of Dublin are jointly taught by the University and the College with whom they are registered. The arrangements are as follows :

[a] **The National University of Ireland**.
Associated colleges:

Mary Immaculate, Limerick,
St. Patrick's Dublin.

Three year degree which may be awarded with honours. One specialist subject is studied together with education including methodology and teaching practice (practicum) in schools.

[b] **The University of Dublin, Trinity College**.
Associated colleges

Froebel College of Education (Dominican).

Three year ordinary degree which is designed to prepare students to teach the subjects of the Irish Primary School curriculum. The foundation subjects in education are taught by the Department of Teacher Education in the University, and students from the colleges come together in a common programme of study in the University. During their studies students undertake teahcing practice in schools (practicum).
Students who wish to obtain honours attend for a fourth year during which they teach in schools throughout the year (second practicum) and in parallel study in the University.

Degree Awarding Systems in Ireland.

Both pass and honours degrees are classified. With reference to the fig. 1 below, all those obtaining a score of 40% and above are regarded as having been successful in the assessment of either a subject or the subjects which comprise a degree. Honours marks are awarded to those who obtain 50% and above. The different levels at which honours are awarded are shown in fig. 2. It should be noted that a student achieving a II.2 is regarded as having obtained quiet a satisfactory honours degree. The majority of honours degrees fall within the 2.1 to 2.2 category. To obtain a first (i.e. *Magna cum laude*) requires a candidate of exceptional calibre. Top marks are awarded only to the best or a first as it is called in the honours system (see below). Only a small percentage of students get firsts. A somewhat larger group obtain the next higher level down as a II:1 Over half of the students will get either a II.2 or a third. (The equivalent gradings in a pass degree are P1 and P2). Of those students who complete courses very few fail.

FIG. 2.

TYPICAL HONOURS MARKING SCHEME

70% and above	I	(first)
60% - 69%	II.1	(two:one
50% - 59%	II.2	(two:two)
40% - 49%	III	
Below 40%	Fail	

These grades are derived from formulae related to the marks obtained in individual subjects and the aggregate of those marks. Transcripts are not provided. The systems used vary from university to university in the British Isles but all universities use external examiners to monitor standards and ensure that in the subject areas standards are approximately similar.

THE EDUCATION AND TRAINING OF TEACHERS IN THE UNIVERSITY OF DUBLIN, TRINITY COLLEGE

Subjects which may be studied:

Bachelor in Education (B. Ed) for Primary Teachers. Three years full-time study including teaching practicum.

Bachelor in Education with honours for holders of the B. Ed degree for Primary teachers (B. Ed honours). One year full time study inclusing teaching practicum.

Bachelor in Education with honours in Home Economics (B. Ed Home Economics). Four years full-time study including teaching practicum.

Bachelor in Education with honours in Music (B. Ed Music). Four years full-time study including teaching practicum.

Higher Diploma in Education (H. Dip. Ed.) for graduates who wish to register as secondary teachers. One year including teaching practicum.

Master in Education (M. Ed.) Post Experience. Two years full-time study., One year course work. One year dissertation.

Degrees by Research. Master of Science (in Education). Master of Letters (in Education) and Doctorate in Philosophy (in Education).

In service Diplomas in Curriculum Studies (Maths, Science and Technology) and, Management in Education.

Admission requirements:

B. Ed., B. Ed. (Home Economics) and B. Ed. (Music) require a good performance in the Leaving Certificate Exanimation. (B. Ed.(Home Economics) - one of the subjects taken in the Leaving Certificate Examination should be Home Economics (Social and Scientific). B. Ed. (Music

- one of the subjects taken in the Leaving Certificate Examination should be music).

B. Ed (Honours).
A good grade in the B. Ed. examination.

H. Dip. Ed.
Must be a graduate (college degree) whose subject area is in one of those listed by the Registration Council.

experience. Persons with good honours degrees are given preference.

Rearch Degrees
Must have a good honours degree and be able to demonstrate that they can do research.

Administrative Arrangements:

For administrative convenience the School of Education is divided into two departments each with its own chair. These Departments are the Department of Higher Education and the Department of Teacher Education. Associated with the Department of Teacher Education are six colleges of Education which specialise in the training of teachers.

Students seeking admission to the B. Ed. register with and become students of one of three colleges (viz: Church of Ireland College of Education, Christian Brothers College of Education (St Marys), and The Froebel College (Dominican).

Students seeking admission to the B. Ed. (Home Economics) register with and become students of St Catherines college of Home Economics.

Students seeking admission to the B. Ed, (Music) register with and become students of one of two colleges (viz: Dublin College of Music and Royal Irish Academy of Music).

Students from all of these Colleges attend the University Department of Teacher Education for their courses in the Foundations of Education (viz: Philosophy, Psychology, Sociology, History, Comparative Education, Curriculum Theory, and Statistics and Evaluation. Primary teachers also follow a course in language studies)

Students seeking admission to the B. ED, (Honours) register with University and receive their instruction in the Department of Teacher Education and other University departments depending on their choice of subject specifcation.

Students seeking admission to the Higher Diploma in Education register with the Department of Teacher Education.

Students seeking admission to the Master in Education programme register with the Department of Higher Education and Research.

Students wishing to pursue a research degree seek admission through the Department of their proposed tutor.

THE HIGHER DIPLOMA IN EDUCATION

All candidates who wish to teach in secondary schools in Ireland must be registered by the Secondary Teachers Registration Council which is a statutory organization reporting directly to the Minister for Education. Candidates for registration must have:

(i) a qualification in Irish.

(ii) a university degree or its equivalent in one of the subjects listed by the Council

(iii) a Higher Diploma in Education.

The Higher Diploma in Education of the University of Dublin is designed to fulfill the requirements of the Registration Council.

All students for the Higher Diploma in Education must register with a school for their teaching practice. Traditionally this takes place each morning from the beginning of the school year which begins in September and ends in June. During the academic terms (semester) of the University the student attends college for the equivalent of two and a half days (5 sessions) per week. Depending on the subject which the student teachers, the stuent is required to attend the university during during the afternoon or in blocks. Tuition in college takes place over 24 weeks (contact hours). The course begins in September in order for support to be provided for students throughout the year. The course is assessed by a combination of assessments of course work undertaken during the year, and terminal examinations set during June.

COMPULSORY COURSES

I. FOUNDATION OF EDUCATION

PHILOSOPHY OF EDUCATION	42 hours
PSYCHOLOGY OF EDUCATION	20 hours
SOCIOLOGY OF EDUCATION	10 hours
HISTORY OF EDUCATION	10 hours
IRISH AND COMPARATIVE EDUCATION	21 hours

II. PROFESSIONAL STATISTICS:

(i) STATISTICS: Assessment and Evaluation: 21 hours
Curriculum Studies: 10 hours

(ii) METHODS OF TEACHING: Group (a): History, English
Business Studies, Geography, Music, Maths.
Students choose one major and one subsidiary subject:

Major Subject	50 hours
Minor Subject	30 hours

Group (b): (1) Modern Languages,
(2) Science and Mathematics.

(iii) MICROTEACHING:	90 hours. 8 hours.
(iv) WORD PROCESSING:	20 hours

III. SCHOOL EXPERIENCE:

GENERAL EXPERIENCE INCLUDING:

Lesson Planning	250 hours.
In-Charge of a class	100 hours.

APPENDIX I

Current Syllabuses for English and Mathematics for the Intermediate Certificate at the Higher and Lower Levels.
(Extracted from Rules and Programme for Secondary Schools. Department of Education, Government Stationery Office)

N.B. A new Junior Certificate is being introduced in 1992 and the syllabuses for this will come into force in September 1989.

2.—ENGLISH

There are two courses in English—English (Lower Course) and English (Higher Course) each leading to the Intermediate Certificate Examination.

The aims of the prescribed courses are:—

(*i*) to stimulate the pupils to think, to speak and to write correctly;

(*ii*) to elicit the pupils' sincere response to their own experience of life and literature;

(iii) to cultivate in the pupils an understanding of and an interest in good literature;

(iv) to teach the pupils certain skills which are essential for effective use of the English language.

The pupils' powers of oral expression should be developed and they should be encouraged at all times to speak articulately, coherently and correctly. Some formal exercises in the speaking of English are desirable; these exercises may take the form of debates and discussions, narration or description of events and experiences, oral summaries of matter read, etc.

Pupils should be given frequent and regular practice in the writing of compositions throughout the three years of the course. They should become familiar, in a way appropriate to their age and experience, with the different kinds of composition (narration, description, exposition, argument) and they should be encouraged to write in a variety of forms (essay, story, talk, letter, etc.) on as varied a range of subjects as their experience and attainment will permit. Due attention should be paid to the orderly presentation of material (paragraph sequence, punctuation, etc.).

The ancillary aspects of composition, such as formal letters, reports, etc., should receive due attention and pupils should be given practice in the writing of the more common type of formal letter (thanks, regret, congratulation, application for post, etc.). Practice, too, is recommended in the writing of simple reports and in the description of familiar objects and processes.

Comprehension exercises can be done satisfactorily both orally and in writing. Suitable material for them may be taken from the books being read in class, or from a suitable book of specially prepared exercises in comprehension.

As far as possible, the study of formal grammar should grow out of the pupils' study of correct English usage. Grammar should be shown to be an aid to clearer understanding and more accurate expression.

It is intended that the Language sections of the examinations should be prepared for progressively over a period of three years. This division of the examination into a Language section and a Literature section is arbitrary; in classroom practice, the closer these two aspects of English study are integrated the better.

The Literature syllabus is designed for study during the last two years of the three preparatory years. During the first year, the teacher is free to choose a suitable preliminary course in Literature. In poetry, any suitable anthology containing poems of a narrative, descriptive or simple lyrical type is recommended; but the teacher may, if he so wishes, choose his own poems from a variety of sources. In prose, works of fiction (whether novels or short stories), travel, adventure, biography, adapted to the capacity of a particular class, are recommended. It is suggested that a major aim during the first year should be to give the pupil increased confidence in written and oral composition, a growing enjoyment of reading and greater confidence in his own powers of understanding.

Pupils should be encouraged to undertake private reading—apart from the prescribed Literature courses—and, for this reason, each school should have a library of suitable books in English.

LOWER COURSE

(1) LANGUAGE SECTION

1. *Prose Composition*

Writing of a composition on a selected topic. A choice of topics covering description, narration and exposition will be given, and the composition may require the use of the letter form. Importance will be attached to the orderly presentation of material and to relevance.

2. *Comprehension*

(*a*) Interpretation and summarizing of a prose passage.

(*b*) Vocabulary exercises; use and meaning of words, phrases and idioms.

3. *Ancillary Skills*

(*a*) Grammar and Usage:

(i) Analysis of the sentence; subject and predicate; functions of clauses, phrases and words in the sentence, (the sentences given for analysis will not be elaborate).

(ii) Correction of common errors.

(iii) Exercises in punctuation, etc.

(*b*) Writing of formal letters and simple reports.
Description of familiar objects and processes.

N.B.—Students will have a choice of (*a*) or (*b*). If they choose (*a*), *only two* of sections (i), (ii), (iii) must be answered.

(2) LITERATURE SECTION

1. *Poetry**: The following poems from the *Intermediate Poetry Anthology*:—

Wordsworth	:	The Solitary Reaper
Hopkins	:	Spring
Bridges	:	London Snow
de la Mare	:	Farewell
Frost	:	Stopping by Woods on a Snowy Evening
Noyes	:	The Highwayman
Spender	:	The Express
Yeats	:	The Fiddler of Dooney
Gogarty	:	Golden Stockings
Ledwidge	:	Thomas MacDonagh
Kavanagh	:	A Christmas Childhood

2. *Prose**: The following pieces from the *Intermediate Prose Anthology*:–

Swift	:	Gulliver and the Giants
Hazlitt	:	The Fight
Lincoln	:	The Gettysburg Address
Benchley	:	Down with Pigeons
Sheridan	:	On the Bridge
O'Sullivan	:	The Lobster Season

3. *Short Stories**: The following stories from the *Intermediate Short Story Anthology*:–

O'Flaherty	:	The Wren's Nest
O'Connor	:	First Confession
McLaverty	:	The Poteen Maker
Behan	:	The Confirmation Suit
Saki	:	The Lumber-Room

Incorrect spelling and punctuation will be penalised in all sections of the examination papers.

HIGHER COURSE

(1) LANGUAGE SECTION

1. *Prose Composition*

A choice of topics will be offered of which one is to be attempted. The topics may involve narration, description, exposition, argument, and the composition may take the form of essay, story, talk, letter, etc. Importance will be attached to the orderly presentation of material and to relevance.

2. *Comprehension*

(*a*) Intensive treatment of prose passages:

e.g.: (i) questions on general sense of long passage;

(ii) questions on meanings implied or suggested in the passage;

(iii) exact explanation of words, phrases or idioms occurring in the passage;

(iv) summary of whole or part of passage, etc.

(*b*) General vocabulary exercises.

3. *Ancillary Skills*

(*a*) Grammar and Usage:

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*The pieces prescribed for the 1985 examination are shown on page 58.

(i) Analysis of the sentence; subject and predicate; function of clauses, phrases and words in sentences.
(ii) Correction of common errors.
(iii) Exercises in punctuation, etc.

(*b*) Writing of formal letters and writing of reports.
Description of familiar objects and processes.

Students will have a choice of (*a*) or (*b*). If they choose (*a*), *only two* of sections (i), (ii) and (iii) must be answered.

(2) LITERATURE SECTION

1. *Poetry**: From the *Intermediate Poetry Anthology*, the following poems together with those prescribed for the Lower Course:–

Wordsworth	:	Upon Westminster Bridge
Keats	:	To Autumn
Hardy	:	The Darkling Thrush
Lawrence	:	Snake
Nash	:	The Terrible People
Betjeman	:	Original Sin on the Sussex Coast
Auden	:	The Unknown Citizen
Thomas	:	And Death shall have no Dominion
Yeats	:	A Prayer for my Daughter
Clarke	:	The Scholar
MacDonagh	:	A Warning to Conquerors
MacNeice	:	Prayer before Birth
Kinsella	:	A Garden on the Point

2. *Prose**: From the *Intermediate Prose Anthology* the following pieces together with those prescribed for the Lower Course:–

Swift	:	A Letter to a Young Gentleman
Goldsmith	:	Adventures of a Strolling Player
Stevenson	:	Walking Tours
Leacock	:	A, B and C: the Human Element in Mathematics
Milne	:	The Happiest Half-hours of Life
O'Faoláin	:	The Great O'Neill

3. *Short Stories**: From the *Intermediate Short Story Anthology*, the following stories together with those prescribed for the Lower Course:–

Lavin	:	The Story of the Widow's Son
Plunkett	:	The Web
Kiely	:	The Dogs in the Great Glen
Golding	:	Billy the Kid
Mansfield	:	The Fly

*The pieces prescribed for the 1985 examination are shown on page 59.

4. *Novels:* One from the following:–

Pride and Prejudice (Austen);
Blackcock's Feather (Walsh).
(School editions will suffice).

5. *Drama* (Shakespeare): One from the following:–

Julius Caesar; As You Like It.
(School editions will suffice).

Questions will be set on each of the three sections, Prose, Short Stories and Novels. Candidates will be required to answer *one* question from each of any *two* of the three sections.

Incorrect spelling and punctuation will be penalised in all sections of the examination papers.

NOTE: ORAL ASSESSMENT IN ENGLISH AT THE INTERMEDIATE CERTIFICATE EXAMINATION

The Intermediate Certificate Examination may include an assessment of oral proficiency.

This will consist of the reading aloud by the candidates of a passage of prose 20-25 lines in length. The candidate will then be questioned on the passage read. This questioning will be followed by a general conversation.

The passage for reading aloud will be selected by the examiner from a text chosen by the candidate from the prescribed matter in any of the prose texts (i.e., prose, short stories and, in the case of the Higher Course, novels).

The following are the Poetry, Prose, Short Stories, etc., prescribed for the Examination in 1985.

ENGLISH (LOWER COURSE)

1. *Poetry:* The following poems from the *Intermediate Poetry Anthology:*–

Shirley	:	Death the Leveller
Herrick	:	To Daffodils
Gray	:	Elegy written in a Country Churchyard
Scott	:	Rosabelle
Shelley	:	The Cloud
Tennyson	:	The Eagle
Hardy	:	Weathers
Belloc	:	Courtesy
Moore	:	Silent, O Moyle
Yeats	:	To a Child Dancing in the Wind
Colum	:	The Drover

2. *Prose:* The following pieces from the *Intermediate Prose Anthology:*–

Swift	:	The Lilliputians
Dickens	:	Mr. Pickwick Goes Sliding
Meagher	:	Speech from the Dock
Twain	:	The Boys' Ambition
Belloc	:	The Death of the Ship
O'Faoláin	:	Cuchulainn Keeps the Gap of the North

3. *Short Stories:* The following stories from *Intermediate Short Story Anthology:*–

O'Flaherty	:	The Rockfish
O'Faoláin	:	The Trout
Plunkett	:	Janey Mary
McLaverty	:	The Wild Duck's Nest
Thurber	:	The Secret Life of Walter Mitty

ENGLISH (HIGHER COURSE)

1. *Poetry:* From the *Intermediate Poetry Anthology*, the following poems together with those prescribed for the Lower Course:–

Chaucer	:	The Squire
Spenser	:	*from* the Fairie Queene
Shakespeare	:	Shall I Compare Thee
Donne	:	Death, be not Proud
Milton	:	When the Assault was Intended to the City
Blake	:	Reeds of Innocence
Wordsworth	:	Expostulation and Reply
Browning	:	Meeting at Night
Hopkins	:	Inversnaid
de la Mare	:	The Owl
Eliot	:	Does the Bird Sing
Higgins	:	Father and Son
Kinsella	:	Handclasp at Euston
Yeats	:	Easter 1916

2. *Prose:* From the *Intermediate Prose Anthology*, the following pieces together with those prescribed for the Lower Course:–

Austen	:	Mr. Collins's Proposal
Conrad	:	The East
AE (George Russell)	:	"Ulster"
Darwin	:	Portrait of a Dog of Character
The Times Educational Supplement	:	Correct English
Flower	:	The Road to the Island

3. *Short Stories:* From the *Intermediate Short Story Anthology* the following stories together with those prescribed for the Lower Course:

Corkery	:	The Breath of Life
O'Connor	:	The Majesty of the Law
Lavin	:	Brother Boniface
Bierce	:	An Occurrence at Owl Creek Bridge
Pritchett	:	The Fly in the Ointment

4. *Novels:* One from the following:-
Typhoon (Conrad); Great Expectations (Dickens).
(School editions will suffice).

5. *Drama:* (Shakespeare): One from the following:–
Henry IV, Pt. I; Romeo and Juliet.
(School editions will suffice).

3.–MATHEMATICS

Preamble

The new syllabuses were originally introduced on the understanding that they would be revised from time to time. The present revised syllabuses in Mathematics for the Intermediate Certificate have resulted from such a review and have evolved after much discussion and consultation. The objectives of the syllabuses are that a student should:

- acquire skill in computing with understanding, accuracy and efficiency;
- acquire an understanding of Mathematical facts and concepts;
- understand the logical structure of Mathematics and the nature of a proof;
- use Mathematical concepts and processes to discover generalisations and applications;
- associate Mathematics with applications from everyday life;
- develop attitudes that lead to appreciation, confidence, initiative and independence;
- develop study habits, reading skill and vocabulary essential for independent progress in Mathematics.

To effectively achieve these objectives the teaching should be resourceful, inventive and creative and should examine the students' environment for the experiences, examples and analogies required to permit the formulation, enrichment and refinement of the fundamental concepts. Ultimately the students should be able to marshall their knowledge so that they could apply it to solve problems.

(Note 1: Each syllabus is divided for the convenience of teaching into three sections. The content of each section approximates to one year's work, depending on the circumstances of the particular class.

Note 2: Section One is common to both the Lower Course and Higher Course.

Note 3: It is recommended that reference be made where appropriate to the history of Mathematics and to the lives of great mathematicians.)

LOWER COURSE

Section One

Sets: Listing of elements of sets. Membership of a set defined by a rule. Subsets, Universe, Null (empty) set. Equality of sets. Venn diagrams. Set operations for two sets. Intersection. Union. Commutative property.

Relations: Couples (ordered pairs). Use of arrow diagrams.

Natural Numbers: Sets of numbers. N, N_0. Sets of divisors. Common divisors. Highest common divisor. Recognition of prime numbers. Pairs of factors. Sets of multiples. Lowest common multiple. Cardinal number of a set. Addition of numbers in N. Commutative property. Numbers and numerals. Place value idea. Meaning of a^n when a, $n \in N_0$.

Bases: Numbers in bases other than denary. Counting in various bases. Interbase conversion to and from base 10. Addition in various bases.

Integers: Set of integers (Z). Order ($<$, $\leqslant$, $>$, $\geqslant$). Addition, subtraction, multiplication and division in the set of integers. Use of arrow diagrams to illustrate order relations and the relations

$$+ a, \quad - a, \quad \times a, \quad \text{for } a \in Z$$

Rational Numbers: Set of rational numbers (Q). Decimals, Fractions, Ratio. Positional order on number line for fractions and decimals. Non-zero positive rationals expressed in the form $a.10^n$, where $n \in Z$ and $1 \leqslant a < 10$.

Computation: Addition, subtraction, multiplication and division of decimals and fractions.

Measure: SI units. Basic units of length, mass and time. Multiples and sub-multiples. Speed. Area (square, rectangle). Volume (rectangular solids). Proportion, percentage. Profit and loss. Percentage discount. Percentage profit. Bills. Rates. Tax. Annual interest.

Algebraic Expressions: Idea of a place holder and variable. Addition and subtraction of simple algebraic expressions such as

$(2x + 3) + (4x - 2)$, $(3x + 2y) - (x + 3y - 4)$,
$(5x^2 + 7x - 2) + (2x^2 - x - 7)$.

Equations: Formation and interpretation of number sentences. Solution set of simple first degree equations in one variable. Graphing of solution set on the number line.

Inequalities: First degree inequalities in one variable in N, Z, Q.

Pattern: Recognition of pattern in simple numerical sequences. Writing down of specific terms of a sequence given the general term.

The Plane *II*: Simple intuitive ideas of point and line and of other subsets such as arcs, closed curves, simple closed curves. Intersection and union of subsets.

The plane is an infinite set of points ..... **Axiom 1**

Between any two points of an arc there is another point of the arc ..... **Axiom 2**

Line: A line is an infinite proper subset of *H*. ..... **Axiom 3**

Every pair of distinct points is contained in one and only one line.
..... **Axiom 4**

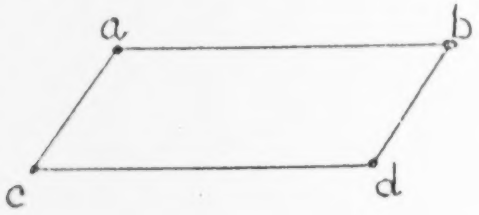
The line containing the points a and b is denoted by ab.
The line segment containing end points a and b is denoted by [a b].

Parallel Lines: Two lines A and B in the plane are parallel if, and only if, $A \cap B = \phi$ or $A = B$. ..... **Definition 1**

Given a line L and a point p, there is one and only one line parallel to L which contains p. ..... **Axiom 5**

Construction: Using set square and ruler, construct through a point a line parallel to a given line.

Parallelograms: abdc is a parallelogram if and only if ab∥cd and ac∥bd. where a, b, c, d are not collinear.



..... **Definition 2**

Equipollent Couples

Non-Collinear Couples: (a, b) is equipollent to (c, d) if and only if abdc is a parallelogram.

Collinear Couples: (a, b) is equipollent to (c, d) if and only if there is a couple (x, y) not collinear with (a, b) such that (a, b) is equipollent to (x, y) and (x, y) is equipollent to (c, d).

Identity Couples: (a, a) is equipollent to (b, b)
..... **Definition 3**

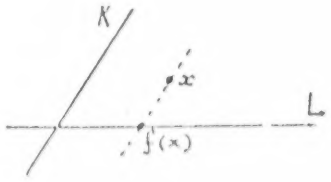
Notation: (a, b) equipollent to (c, d) is denoted by (a, b) ↑ (c, d).

Corollary 1. (a, b) ↑ (c, d) ⇒ (b, a) ↑ (d, c).

Corollary 2. For non-collinear couples
(a, b) ↑ (c, d) ⇒ (a, c) ↑ (b, d).

Transitivity and Equipollence:
(a, b) ↑ (c, d)
and ⇒ (a, b) ↑ (e, f) ..... **Axiom 6**
(c, d) ↑ (e, f)

Parallel Projection of II:
f(x) is the image of x under the projection on L parallel to K.



..... Definition 4

Construction of the image of a set under a projection f: $x \to f(x)$.

Translation of *II*: The translation $\overrightarrow{ab}$ is the set of all couples (c, d) such that (c, d) $\uparrow$ (a, b) ..... Definition 5

Construction of the image of a set under a translation f: $x \to f(x)$.

Centre: c is the centre of a couple (a, b) if and only if (a, c)$\uparrow$ (c, b).

..... Definition 6

Central Symmetry of *II*: The central symmetry S_c is the set of all couples such that c is the centre of each of them. ..... Definition 7

Construction of the image of a set under a central symmetry f: $x \to f(x)$.

Section Two

Sets: Set operations: difference, complement. Set operations extended to three sets. Associative property. Necessity of brackets for the non-associative operation of difference.

Relations and Functions: Domain and range. Function (map) as a special relation.

Rational Numbers: Rational numbers expressed as decimals. Terminating decimals expressed as fractions.

Real Numbers: Elementary concept of the real number system using the number line. Rational approximations for irrational numbers such as $\sqrt{2}$ and π for calculation purposes. Calculation to a specified degree of accuracy involving addition, subtraction, multiplication and division. Associative property of addition and of multiplication. Non-associativity of subtraction and of division. Distributive property of multiplication over addition. Non-distributivity of addition over multiplication. Inequalities in R.

Algebraic Expressions: Use of distributive property in the removal of brackets in such expressions as $3(x + 4) - 5(2x + 3) + 2(5x - 6)$. Multiplication of expressions such as $(2x - 3)(5x + 4)$, $(x - 4)(x^2 - 5x + 11)$ etc. Division of expressions such as $(2x^2 + 11x - 15) \div (x + 3)$, $(6x^2 + x - 12) \div (3x - 4)$, $(6x^3 - x^2 - 33x - 28) \div (3x + 4)$.

Factors: Use of the distributive law in the factorising of such expressions as: $6xy + 3y^2$, $ax - by + bx - ay$. Factors of quadratic expressions of the form $x^2 + bx + c$, where b, c are in Z.

Equations: Quadratic equations of the form $x^2 + px + q = 0$ where $x^2 + px + q$ is readily factorisable.

Statistics: Drawing and interpreting pictograms, bar-charts, pie-charts, trend graphs.

Tables: Use of formulas provided in the table book for length of circle and surface area enclosed by a circle.

Logarithms: Use of logarithmic tables (or slide rule) in calculations not involving negative characteristics. Calculation of square root by use of tables or by an approximation method.

Direction: Direction as a set of parallel lines. ..... **Definition 8**
To every direction there is one, and only one, direction perpendicular to it. ..... **Axiom 7**

Construction: Use of set square to draw a perpendicular to a line through a point.

Axial Symmetry of *H*:
The axial symmetry S_L in a line L is the set of all couples (a, b) such that
(i) $ab \perp L$
(ii) centre of (a, b) $\in$ L ..... **Definition 9**
Construction of the image of a set under an axial symmetry f: $x \rightarrow f(x)$.

Rotation of *H*: The axial symmetry in an axis A followed by the axial symmetry in an axis B, where A and B are not disjoint, defines the rotation $S_B \circ S_A$. ..... **Definition 10**
Construction of the image of a set under a rotation f: $x \rightarrow f(x)$.

Angle: An angle is formed by two half-lines [oa and [ob and is called $\angle aob$ or $\angle boa$.

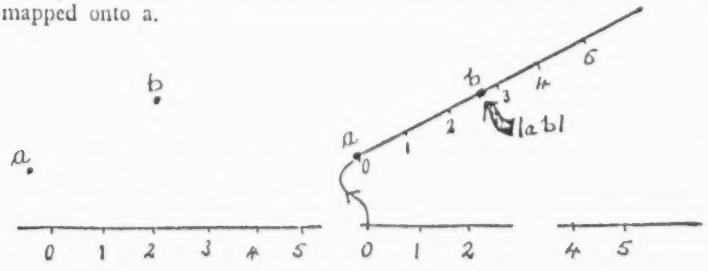
Measure of an angle in degrees.

Measure of $\angle aob$ is written as $|\angle aob|$.

If [oa and [ob are collinear, thus

then $\angle aob$ is called a straight angle and $|\angle aob| = 180°$.

Distance:
The distance, |a b|, between two points a and b is the real number which is mapped onto b when the number line is mapped by a translation, a rotation or a combination of these onto ab such that 0 is mapped onto a.



Translation, central symmetry and axial symmetry conserve length, area and measure of angle. ..... **Axiom 8**
Parallel projection conserves equipollence (no proof required).

Construction:

Bisect a given line segment. Midpoint of [ab] is centre of (a, b).

Section Three

Relations and Functions: Coordinating the plane. Drawing graphs of functions $f: x \to f(x)$, where $f(x)$ is of the forms $3x + 4$, $x^2 - 5x + 6$.

Equations: First degree equations in two variables. Problems, solutions and graphical treatment.

Compound Interest: Calculation of compound interest — interest added annually for up to 3 years (formula not required).

Tables: Use of formulae provided in the table book for surface area and volume of cylinder and sphere.

Statistics: Expression of discrete array as a frequency table. Mean and mode.

Algebraic Expressions: Addition and subtraction of algebraic expressions such as

$$\frac{a}{bx + c} \pm \frac{p}{qx + r}, \text{ where } a, b, c, p, q, r \in Z.$$

Quadratic Functions: Graphical illustration of quadratic functions.

Factors: Factors of quadratic expressions of the form $ax^2 + bx + c$ where "a" is a prime number. Factorisation of the difference of the two squares.

Equations: Quadratic equations in one variable (rational roots only). Use of formula acceptable but not essential. Simple problems leading to quadratic equations.

Trigonometry: Cosine, sine and tangent of angles. Reading trigonometrical tables. Solving right angled triangle problems of a simple nature in heights and distances with the aid of trigonometry. (Theorem of Pythagoras may be assumed.)

(Proofs of theorems are to be based on the content of the syllabus. It is assumed that many of the theorems have already been verified by the pupil.)

Theorem 3.1 Diagonals of a parallelogram bisect each other. (Converse may be assumed to be true.)

Theorem 3.2 Translation maps a line onto a parallel line.

Theorem 3.3 Central symmetry maps a line onto a parallel line.

Theorem 3.4 When a transversal cuts two parallel lines, then
(a) corresponding angles are equal in measure;
(b) alternate angles are equal in measure.
(Converse may be assumed to be true.)

Theorem 3.5 The sum of the measures of the three angles of a triangle is 180°.

Theorem 3.6 The measure of the exterior angle of a triangle equals the sum of the measures of the two interior opposite angles.

If [oa and [ob are two half lines, then there is one, and only one, line M such that S_M maps [oa on [ob. ..... **Axiom 9**

M is called the bisector of ∠aob.

Theorem 3.7 If two sides of a triangle are equal in length, then the measure of the angles opposite these sides are also equal. (Converse may be assumed to be true.)

Construction Bisect a given angle.

The distance of a point x from a line L is |xa|, where xa $\perp$ L and a $\in$ L. ..... **Definition 11**

The area of a parallelogram abcd is |ab|.h, where h is the distance of c from ab. ..... **Definition 12**

Theorem 3.8 A diagonal of a parallelogram bisects the area of the parallelogram.

Theorem 3.9 The area of a triangle abc is $\frac{1}{2}$ |ab|.h, where h is the distance of c from ab.

Theorem 3.10 If x $\in$ M, the perpendicular bisector (mediator) of a line segment [ab], then |xa| = |xb|. (Converse may be assumed to be true.)

Definition of Circle K: $K = \{x \mid |xc| = r, c \in \Pi, r \in R\}$, where c is a fixed point and r a fixed number, c is the centre of K and r is the length of a radius of K. ..... **Definition 13**

Construction Construct, with proof, the circumcircle of a triangle.

Theorem 3.11 Any point of the bisector of ∠aob is equidistant from oa and ob. (Converse may be assumed to be true.)

Theorem 3.12 A circle is mapped onto itself by the axial symmetry in any line through its centre.

Theorem 3.13 The diameter of a circle which is perpendicular to a chord of the circle bisects the chord.

A line L is tangent to a circle K at the point t if L intersection K = {t}. ..... **Definition 14**

Theorem 3.14 The diameter of a circle which is perpendicular to a tangent contains the point of contact.
(Converse may be assumed to be true.)

Construction Construct, with proof, the incircle of a triangle.

Theorem 3.15 The angle at a point of a circle standing on a diameter is a right angle. (Converse may be assumed to be true.)

Construction Construct, with proof, a tangent to a circle through a point (i) belonging to the circle, (ii) outside the circle.

HIGHER COURSE

Section One

Sets: Listing of elements of sets. Membership of a set defined by a rule. Subsets, Universe, Null (empty) set. Equality of sets. Venn diagrams. Set operations for two sets. Intersection. Union. Commutative property.

Relations: Couples (ordered pairs). Use of arrow diagrams.

Natural Numbers: Sets of numbers. N, N_0. Sets of divisors. Common divisors. Highest common divisor. Recognition of prime numbers. Pairs of factors. Sets of multiples. Lowest common multiple. Cardinal number of a set. Addition of numbers in N. Commutative property. Numbers and numerals. Place value idea. Meaning of a^n when $a, n \in N_0$.

Bases: Numbers in bases other than denary. Counting in various bases. Interbase conversion to and from base 10. Addition in various bases.

Integers: Set of integers (Z). Order ($<$, $\leqslant$, $>$, $\geqslant$). Addition, subtraction, multiplication and division in the set of integers. Use of arrow diagrams to illustrate order relations and the relations

$$+ a, \qquad - a, \qquad \times a, \qquad \text{for } a \in Z.$$

Rational Numbers: Set of rational numbers (Q). Decimals, Fractions, Ratio. Positional order on number line for fractions and decimals. Non-zero positive rationals expressed in the form $a.10^n$, where $n \in Z$ and $1 \leqslant a < 10$.

Computation: Addition, subtraction, multiplication and division of decimals and fractions.

Measure: SI units. Basic units of length, mass and time. Multiples and sub-multiples. Speed. Area (square, rectangle). Volume (rectangular solids). Proportion, percentage. Profit and loss. Percentage discount. Percentage profit. Bills. Rates. Tax. Annual interest.

Algebraic Expressions: Idea of a place holder and variable. Addition and subtraction of simple algebraic expressions such as
$(2x + 3) + (4x - 2)$, $(3x + 2y + 7) - (x + 3y - 4)$,
$(5x^2 + 7x - 2) + (2x^2 - x - 7)$.

Equations: Formation and interpretation of number sentences. Solution set of simple first degree equations in one variable. Graphing of solution set on the number line.

Inequalities: First degree inequalities in one variable in N, Z, Q.

Pattern: Recognition of pattern in simple numerical sequences. Writing down of specific terms of a sequence given the general term.

The Plane *II*: Simple intuitive ideas of point and line and of other subsets such as arcs, closed curves and simple closed curves. Intersection and union of subsets.

The plane is an infinite set of points ..... **Axiom 1**

Between any two points of an arc there is another point of the arc. ..... **Axiom 2**

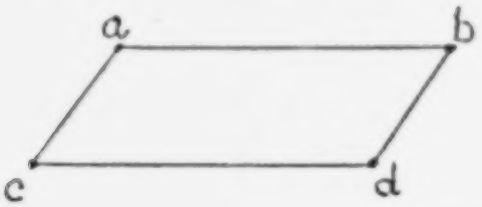
Line: A line is an infinite proper subset of *II* ..... **Axiom 3**
Every pair of distinct points is contained in one and only one line. ..... **Axiom 4**
The line containing the points a and b is denoted by ab.
The line segment containing end points a and b is denoted by [a b].

Parallel Lines: Two lines A and B in the plane are parallel if, and only if, $A \cap B = \phi$ or $A = B$. ..... **Definition 1**

Given a line L and a point p, there is one and only one line parallel to L which contains p. ..... **Axiom 5**

Construction: Using set square and ruler, construct through a point a line parallel to a given line.

Parallelograms: abdc is a parallelogram if and only if ab∥cd and ac∥bd, where a, b, c, d are not collinear.



..... **Definition 2**

Equipollent Couples

Non-Collinear Couples: (a, b) is equipollent to (c, d) if and only if abdc is a parallelogram.

Collinear Couples: (a, b) is equipollent to (c, d) if and only if there is a couple (x, y) not collinear with (a, b) such that (a, b) is equipollent to (x, y) and (x, y) is equipollent to (c, d).

Identity Couples: (a, a) is equipollent to (b, b)

..... **Definition 3**

Notation: (a, b) equipollent to (c, d) is denoted by (a, b) ↑ (c, d).

Corollary 1. (a, b) ↑ (c, d) ⇒ (b, a) ↑ (d, c).

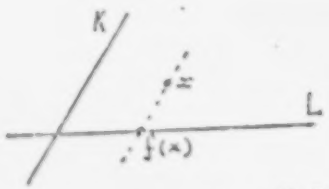
Corollary 2. For non-collinear couples
(a, b) ↑ (c, d) ⇒ (a, c) ↑ (b, d).

Transitivity of Equipollence:

$$\left.\begin{array}{l}(a, b) \uparrow (c, d) \\ \text{and} \\ (c, d) \uparrow (e, f)\end{array}\right\} \Rightarrow (a, b) \uparrow (e, f) \quad \text{..... Axiom 6}$$

Parallel Projection of II:

f(x) is the image of x under the projection on L parallel to K.



..... **Definition 4**

Construction of the image of a set by a projection f : x → f(x).

Translation of II: The translation $\overrightarrow{ab}$ is the set of all couples (c, d) such that (c, d) ↑ (a, b) ..... **Definition 5**

Construction of the image of a set under a translation f: x → f(x).

Centre: c is the centre of a couple (a, b) if and only if (a, c) ↑ (c, b).

..... **Definition 6**

Central Symmetry of II: The central symmetry S_c is the set of all couples such that c is the centre of each of them.

..... **Definition 7**

Construction of the image of a set under a central symmetry f: x → f(x).

Section Two

Sets: Set operations; difference, complement, symmetric difference. Set operations extended to three sets. Associative property. Necessity of brackets for the non-associative operation of difference. Cardinal number. Closure of a set under an operation.

Relations and Functions: Cartesian product of two sets. Domain and range. The reflexive, symmetric and transitive properties of such simple relations as equality, parallelism etc. Function (map) as a special relation. Notion of inverse of a function. Composition of functions. Coordinating the plane. Drawing graphs of functions $f: x \to f(x)$, where $f(x)$ is of the form $3x + 4$, $x^2 - 5x + 6$.

Equations: First degree equations in two variables. Problems, solutions and graphical treatment.

Rational Numbers: Rational numbers expressed as decimals. Terminating decimals expressed as fractions. Illustration of the fact that a non-terminating repeating decimal is rational.

Real Numbers: Elementary concept of the real number system using the number line. Rational approximations for irrational numbers such as $\sqrt{2}$ and π for calculation purposes. Calculation to a specified degree of accuracy involving addition, subtraction, multiplication and division.

Addition is associative and commutative. Multiplication is associative and commutative. Non-associativity of subtraction and of division. Non-distributivity of addition over multiplication. Inequalities in R.

Numerical Calculations: Calculation of compound interest – interest to be added annually for up to three years (formula not required). Use of mathematics tables (or slide rule) in calculations. Square root by mathematics tables or by approximation method. Use of formulae provided in mathematics tables for length of circle; area of disc, surface area of cylinder, cone and sphere; volume of cylinder, cone and sphere.

Trigonometry: Cosine, sine and tangent of angles. Values of these functions for 0°, 30°, 45°, 60°, 90°, 180°, 270°, 360°, where defined.

Algebraic Expressions: Use of distributive property in the removal of brackets. Multiplication and division of expressions including the expansion of $(x + y)^2$, $(x - y)^2$, $(x + y)^3$, $(x - y)^3$.

Factors: Use of distributive law in the factorising of such expressions as $6xy + 3y^2$, $ax - by + bx - ay$. Factors of expressions of the form $ax^2 + bx + c$. Factors of such expressions as $x^2 - 4y^2$, $x^3 - y^3$, $x^3 + y^3$.

Equations: Quadratic equations of the form $ax^2 + bx + c = 0$, where $ax^2 + bx + c$ is factorisable.

Statistics: Drawing and interpreting pictograms, bar-charts, pie-charts, trend graphs. Moving averages.

Direction: Direction as a set of parallel lines. . . . . Definition 8
To every direction there is one and only one direction perpendicular to it. . . . . Axiom 7

Deduction from axiom 7:
(for example) $A \perp B \parallel C \Rightarrow A \perp C$; $A \perp B \perp C \Rightarrow A \parallel C$.

Construction: Use of set square to draw perpendicular to a line through a point.

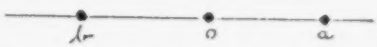
Axial Symmetry of Π:
The axial symmetry S_L in a line L is the set of all couples (a, b) such that
(i) $ab \perp L$
(ii) Centre of (a b) $\in$ L ..... Definition 9
Construction of the image of a set under an axial symmetry $f : x \mapsto f(x)$.
Composition of two or more axial symmetries.

Rotation of Π: The axial symmetry in an axis A followed by the axial symmetry in an axis B, where A and B are not disjoint, defines the rotation $S_B \circ S_A$. ..... Definition 10
Construction of the image of a set under a rotation $f : x \to f(x)$.

Angle: An angle is formed by two half-lines [oa and [ob and is called $\angle aob$ or $\angle boa$.
Measure of an angle in degrees.

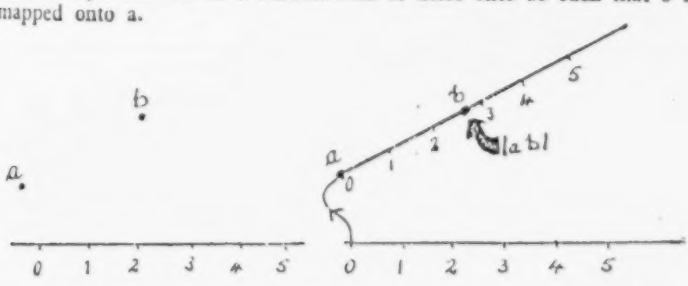
Measure of $\angle aob$ is written $|\angle aob|$.

If [oa and [ob are collinear, thus



then $\angle aob$ is called a straight angle and $|\angle aob| = 180°$.

Distance: The distance, |ab|, between two points a and b, is the real number which is mapped onto b when the number line is mapped by a translation, a rotation or a combination of these onto ab such that 0 is mapped onto a.



Isometry of Π: Translation, central symmetry and axial symmetry conserve length, area and measure of angle. ..... Axiom 8
(Proofs of theorems are to be based on the content of the syllabus. It is assumed that many of the theorems have already been verified by the pupil.)

Theorem 2.1	Parallel projection conserves equipollence.
Construction	Bisect a given line segment.
	Midpoint of [a b] is centre of (a, b).
Theorem 2.2	For collinear couples
	(a, b) ↑ (c, d) ⇒ (a, c) ↑ (b, d).
Theorem 2.3	The composition of two translations is a translation.
	(Note: The composition of $\overrightarrow{ab}$ and $\overrightarrow{ab}$ is written as $\overrightarrow{2\ ab}$.)
Theorem 2.4	The composition of two central symmetries is a translation.
Theorem 2.5	The composition of two axial symmetries in perpendicular axes is a central symmetry.
Theorem 2.6	The composition of two axial symmetries in parallel axes is a translation.

Section Three

Functions: Maximum or minimum value of a quadratic function found graphically. Solution of a quadratic inequality found from the graph of a quadratic function.

Equations: Quadratic equations of the form $ax^2 + bx + c = 0$ — real roots only.

Algebraic Expressions: Addition and subtraction of algebraic expressions such as

$$\frac{a}{bx + c} \pm \frac{p}{qx + r}, \text{ where } a, b, c, p, q, r \in Z.$$

Indices and Logarithms: $\text{Log}_c a = x \Rightarrow a = c^x$. Justification of

(i) $\log_c ab = \log_c a + \log_c b$. (ii) $\log_c \frac{a}{b} = \log_c a - \log_c b$

(iii) $\log_c a^p = p \log_c a$ (iv) $\log_c a = \frac{\log_{10} a}{\log_{10} c}$.

Numerical applications.

Trigonometry: Reading trigonometrical tables. Solving right angled triangle problems of a simple nature (e.g. height and distance). Area of triangle. Sine rule with applications.

Coordinate Geometry: Coordinates of the images of points by projection, translation, central symmetry and axial symmetry. Distance. Midpoint. Slope of line. Area of triangle.

Equation of line in the forms $y = mx + c$ and $y - y_1 = m(x - x_1)$. Intersection of lines. Equation of the image of a line by a translation. Equation of the image of a line $y = mx$ by the rotation $S_Y \circ S_L$, where Y is the y-axis and L is the line $y = x$, is $y = -\frac{1}{m}x$.

Statistics: Expression of a discrete array as a frequency table. Mean and mode.

(Proofs of theorems are to be based on the content of the syllabus. It is assumed that many of the theorems have already been verified by the pupil.)

Theorem 3.1	Diagonals of a parallelogram bisect each other. (Converse may be assumed to be true.)
Theorem 3.2	Translation maps a line onto a parallel line.
Theorem 3.3	Central symmetry maps a line onto a parallel line.
Theorem 3.4	When a transversal cuts two parallel lines, then (a) corresponding angles are equal in measure; (b) alternate angles are equal in measure. (Converse may be assumed to be true.)

Theorem 3.5 The sum of the measures of the three angles of a triangle is 180°.

Theorem 3.6 The measure of the exterior angle of a triangle equals the sum of the measures of the two interior opposite angles.

If [oa and [ob are two half lines, then there is one, and only one, line M such that S_M maps [oa on [ob. ..... **Axiom 9**

M is called the bisector of ∠aob.

Theorem 3.7 If two sides of a triangle are equal in length, then the measures of the angles opposite these sides are also equal (Converse may be assumed to be true.)

Construction Bisect a given angle.

The distance of a point x from a line L is $|xa|$, where $xa \perp L$ and $a \in L$. ..... **Definition 11**

The area of a parallelogram abcd is $|ab|.h$, where h is the distance of c from ab. ..... **Definition 12**

Theorem 3.8 A diagonal of a parallelogram bisects the area of the parallelogram.

Theorem 3.9 The area of a triangle abc is $\frac{1}{2}|ab|.h$, where h is the distance of c from ab.

Theorem 3.10 If $x \in M$, the perpendicular bisector (mediator) of a line segment [ab], then $|xa| = |xb|$. (Converse may be assumed to be true.)

Definition of Circle K: $K = \{x \mid |xc| = r, c \in \Pi, r \in R\}$, where c is a fixed point and r a fixed number, c is the centre of K and r is the length of a radius of K. ..... **Definition 13**

Construction Construct with proof the circumcircle of a triangle.

Theorem 3.11 Any point of the bisector of ∠aob is equidistant from oa and ob. (Converse may be assumed to be true.)

Theorem 3.12 A circle is mapped onto itself by the axial symmetry in any line through its centre.

Theorem 3.13 The diameter of a circle which is perpendicular to a chord of the circle bisects the chord.

A line L is tangent to a circle K at the point t if L intersection K = {t}. ..... **Definition 14**

Theorem 3.14 The diameter of a circle which is perpendicular to a tangent contains the point of contact. (Converse may be assumed to be true.)

Construction Construct, with proof, the incircle of a triangle.

Theorem 3.15 The measure of the angle at the centre of a circle is twice the measure of an angle at the circle standing on the same arc.

Deduction 1 All the angles at the circle standing on the same arc are equal in measure.

Deduction 2 An angle at the circle standing on a diameter is a right angle. (Converse may be assumed to be true.)

Construction Construct, with proof, a tangent to a circle through a point (i) belonging to the circle, (ii) outside the circle.

Theorem 3.16 The perpendicular bisectors of the sides of a triangle are concurrent.

Theorem 3.17 The bisectors of the interior angles of a triangle are concurrent.

Theorem 3.18 The areas of two triangles of equal height are proportional to the lengths of their bases.

Theorem 3.19 Two sides of a triangle are divided proportionally by a line drawn parallel to the third side. (Converse may be assumed to be true.)

Theorem 3.20 If the angles of two triangles are equal in measure, then the lengths of their corresponding sides are proportional. (Converse may be assumed to be true.)

Theorem 3.21 [ab] and [cd] are two chords of a circle. If the lines ab and cd intersect at k, then
$|ak| \cdot |kb| = |ck| \cdot |kd|$.

Deduction From a point p outside a circle a tangent is drawn to touch the circle at t and a line is drawn to cut the circle at a and b, then
$|pa| \cdot |pb| = |pt|^2$.
(Converse may be assumed to be true.)

Theorem 3.22 Theorem of Pythagoras.
(Converse may be assumed to be true.)